

REMARKS

Claims 1, 2, 4-7 and 9-12 are pending. Claims 1, 2, 4-7 and 9-12 are rejected. Claims 1, 2, 4, 9, 11 and 12 are amended herein. Attached hereto is a marked-up version of the changes made by the current amendment.

Claim Rejections under 35 U.S.C. §112, first paragraph

Claims 4 and 9 are rejected under 35 U.S.C. §112, first paragraph, because the specification, while being enabling for a roughened surface having grooves made by drilling or broaching, does not reasonably provide enablement for a roughened surface having grooves made by etching, shot blasting, etc.

Regarding the shot blasting, it also forms rough surface because steel grids or sand particles impinge on a workpiece. Applicants note that the surfaces are grooved, and may further be roughened by etching, shot blasting, etc.

Applicants note that the surface forming by etching is smoother than that formed by drilling or the like but still has roughness due to selective attack of the etchant in the metallic structure. The metallic material is polycrystalline, so that the etching rate of grain boundaries is different from that of the crystal grains. Different etch rates of the different materials is one of the reasons that the roughness is formed on the etched surface.

Therefore, Applicants amend the claims to recite that “said roughened surface is **formed further roughened** by shot-blasting, etching, flame-spraying or chemical treatment.” Applicants submit that the amendments overcome the rejection, and request that it be withdrawn.

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. §112, first paragraph, because the specification, while being enabling for a sliding bearing of the claimed structure that is formed from a homogeneous copper alloyed structure that is subject to use in order to obtain the claimed elevated Ag/Sn(additive element) composition near the vicinity of the roughened surface, does not provide enablement for a sliding bearing of the claimed structure that is formed in any other manner.

The Examiner asserts that Applicants have taught that the disclosed methodology of incorporating a homogeneous copper alloy composition in a structure comprising the claimed backing layer, said copper alloy, and an overlay, and subjecting the laminate to working engine conditions to create the claimed structure having a concentrated surface layer is critical. The Examiner points specifically to page 7, lines 26-36 of the specification. The Examiner asserts that “as currently drafted, the claim encompasses structure made by other processes.”

Applicants respectfully traverse the Examiner’s rejection. The Examiner’s basis for rejection, i.e., that “as currently drafted, the claim encompasses structure made by other processes”, is not grounds for rejection. The only question concerning enablement is whether Applicants have disclosed a method for making the claimed bearing. Applicants submit that they have. Moreover, Applicants note that the cited portion in the specification appears to merely describe a reason why the present invention has the property that additive elements in the alloy do not easily precipitate. This is not a statement of criticality. Applicants respectfully request that the rejection be withdrawn.

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. Applicants’ recitation of a “sublayer that is not directly

adjacent said backing metal” is new matter, as it comprises a negative limitation without antecedent support in the originally filed Specification.

Applicants respectfully traverse the rejection. Applicants note that the amendment to the claim created a recitation of a “sublayer that is not adjacent to the backing metal.” This clarification was effected merely to more clearly define the sublayer that was originally claimed as a “sublayer of at least a portion of the sliding layer.” The amendment was in response to the Examiner’s rejection of the claim as unclear.

Applicants further note that the layers 2a and 2b in Figure 1 correspond to the “layer parallel to and adjacent to said backing metal” (2b) and a “sublayer that is not directly adjacent to said backing metal” (2a). Both of these layers are clearly shown in Figure 1.

Because of continuing lack of clarity leading to confusion on the part of the Examiner, Applicants herein clarify the claim to recite “said alloy having ~~defined~~ a first layer parallel to and adjacent to said backing metal, and a ~~sublayer~~ second layer that is not directly adjacent to said backing metal”. Subsequent referrals to these layers are more easily understood. Applicants submit that the amendments overcome the rejection, and request that it be withdrawn.

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. §112, first paragraph, because the specification, while being enabling for a sublayer that comprises at least one of the Ag/Sn (or additive element) solid dissolved components wherein the Ag/Sn (or additive element) is solid dissolved in copper matrix, does not reasonably provide enablement for Ag/Sn (or additive element) solid dissolved in other matrices.

Applicants do not fully understand the Examiner's rejection of this claim, and believe that the unamended claims were unclear to the Examiner. Applicants note that the invention is drawn to a copper alloy, and claims a copper alloy. Applicants respectfully note that it is not important to describe that which is not claimed.

Claim Rejections under 35 U.S.C. §112, second paragraph

Claims 1, 2, 4-7 and 9-12 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants regard as the invention.

Regarding Claims 1 and 2, with respect to the composition of the copper alloy, it is unclear whether the composition is limited to the claimed ingredients or may comprise additional ingredients. Applicants recite that the copper alloy contains certain amounts of Ag and Sn, with the balance consisting essentially of Cu, for example, in Claim 1. Therefore, Applicants have not clarified whether the alloy comprises Ag, Sn, and Cu or consists essentially of Ag, Sn, and Cu.

Applicants note the Examiner's comments, and herein clarify the claims to change "comprising" and "containing" to the term "consisting essentially of", which is broader than the term "consisting of". Applicants submit that the amendments overcome the rejection, and request that it be withdrawn.

Regarding Claims 1 and 2, the Examiner asserts that it is unclear what is meant by the phrase "said alloy having defined a layer parallel to and adjacent to said backing metal." It is unclear what constitutes a parallel layer. It is unclear whether what is claimed is a backing metal

on which is directly disposed a layer comprising a copper alloy or something else. It is unclear whether the claimed sublayer is part of the claimed layer or whether the claimed layer and claimed sublayer are distinct and separate layers.

Because of continuing lack of clarity leading to confusion on the part of the Examiner, Applicants herein clarify the claim to recite “said alloy having ~~defined~~ a first layer parallel to and adjacent to said backing metal, and a ~~sublayer~~ second layer that is not directly adjacent to said backing metal”. Subsequent referrals to these layers are more easily understood.

Applicants respectfully traverse the Examiner’s rejection. Applicants note that the recitation, as herein amended, is of a backing metal upon which is an alloy, and the alloy has a first layer adjacent to said backing metal, and a second layer that is not directly adjacent to said backing metal. Applicants further note that the layers 2a and 2b in Figure 1 correspond to the “first layer adjacent to said backing metal” (2b) and a “second layer that is not directly adjacent to said backing metal” (2a). The layers of the alloy are distinct from each other because the second layer has higher total atomic concentration of Ag and Sn than that of said first layer. Both of these layers are clearly shown in Figure 1. Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Regarding Claims 1 and 2, it is unclear what is meant by the phrase “at least the vicinity of said roughened surface.”

Applicants herein amend the claim to recite “~~vicinity of~~ area adjacent said roughened surface”, which Applicants assert overcomes the rejection. Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Regarding Claims 1 and 2, it is unclear what is the relationship between "a portion of said sublayer" and "said sublayer."

Applicants note that the recitation of "a portion of said sublayer" may have been redundant, and therefore delete the phrase "at least a portion of" from the claims. Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Regarding Claims 1, 2, 11 and 12, it is unclear what is the antecedent basis of the phrase "said layer nearest said backing metal."

Because of continuing lack of clarity leading to confusion on the part of the Examiner, and as noted above, Applicants herein clarify the claim to recite "said alloy having ~~defined~~ a first layer parallel to and adjacent to said backing metal, and a ~~sublayer~~ second layer that is not directly adjacent to said backing metal". Subsequent referrals to these layers are more easily understood. Following this amendment, there is no need for the term, "said layer ~~nearest said backing metal~~", which has also been deleted. Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Regarding Claims 11 and 12, it is unclear what is meant by the phrase "the total atomic concentration".

Applicants herein amend the claim to read, "the ~~total atomic~~ concentration of". Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Further, it is unclear what is the antecedent basis of the phrases "said hexagonal compound" and "said eutectic" as the parent claims make reference to more than one of each of these.

In order to clarify the claims, Applicants herein amend the claims by introducing a parent term that encompasses any of the five additives. Applicants have amended claim 1 to read, “wherein said second layer contains a second-layer component consisting of one of:

- solid-dissolved Ag and Sn,
- a hexagonal compound of solid-dissolved Ag and Sn,
- a hexagonal compound of Cu and solid-dissolved Ag and Sn,
- a eutectic of solid-dissolved Ag and Sn, or
- a eutectic of Cu and solid-dissolved Ag and Sn...”

With this amendment, there is no longer a need to refer to “said hexagonal compound” and “said eutectic”; rather, the claims now refer to, “said second-layer component”. Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Regarding Claims 1 and 2, it is unclear what is the antecedent basis of the phrase “the copper matrix.”

Applicants respectfully traverse the rejection, and note that a Cu matrix is a necessary portion of any copper alloy. Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

Regarding Claims 4 and 9, it is unclear whether the claimed formation methods are intended to be exclusive of a method for making the grooved aspect or whether the claimed formation methods refer to the post-groove formation step in which the claimed degree of roughness is to be achieved.

Applicants note that the surfaces are grooved, and may further be roughened by etching, shot blasting, etc. Therefore, Applicants herein amend the claims to recite that “said roughened surface

Amendment under 37 C.F.R. §1.111
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is ~~formed~~ further roughened by shot-blasting, etching, flame-spraying or chemical treatment.”

Applicants submit that the claim is now clear, and request that the rejection be withdrawn.

For at least the above reasons, Applicants submit that the present amendments overcome the rejections to the claims. Passage of the claims to issue is earnestly requested.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants’ undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees that may be due with respect to this paper to Deposit Account No. 01-2340.

Respectfully submitted,

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PATENT TRADEMARK OFFICE

Enclosures: Version with markings to show changes made

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend claims 1, 2, 4, 9, 11 and 12 as follows:

1. (Three Times Amended) A sliding bearing for supporting an opposing shaft movable in a sliding direction against said sliding bearing, said sliding bearing comprising:

a backing metal, and

a copper alloy ~~containing~~ consisting essentially of from 0.1 to 2% by weight of Ag and from 1 to 10% by weight of Sn, the balance of the alloy consisting essentially of Cu, said alloy bonded to said backing metal, and having on its side opposite to the backing metal a roughened surface of approximately 0.5 to approximately 10 μm of roughness (Rz);

said alloy having ~~defined~~ a first layer parallel to and adjacent to said backing metal, and a ~~sublayer~~ second layer that is not directly adjacent to said backing metal;

wherein said roughened surface is coated with a coating layer comprising at least one thermosetting resin, which is selected from the group consisting of polyimide resin, polyamide-imide resin, epoxy resin and phenol resin, and which contains from 55 to 95% by weight of MoS_2 , and wherein said roughened surface is formed of grooves extending in the sliding direction;

wherein Ag and Sn are solid-dissolved ~~in the Cu matrix of~~ the copper alloy in at least the vicinity of area adjacent said roughened surface, where essentially no secondary phase of either Ag or Sn or both is formed;

and,

wherein ~~at least a portion of said sublayer~~ second layer contains a second-layer component consisting of one of:

- solid-dissolved Ag and Sn,
- a hexagonal compound of solid-dissolved Ag and Sn,
- a hexagonal compound of Cu and solid-dissolved Ag and Sn,
- a eutectic of solid-dissolved Ag and Sn, or
- a eutectic of Cu and solid-dissolved Ag and Sn;

in higher ~~total atomic~~ concentration of Ag and Sn than that of said first layer ~~nearest said backing metal~~.

2. (Three Times Amended) A sliding bearing for supporting an opposing shaft movable in a sliding direction against said sliding bearing, said sliding bearing ~~comprising:~~ consisting essentially of a copper alloy containing from 0.1 to 2% by weight of Ag, from 1 to 10% by weight of Sn, and 10% by weight or less of at least one additive element selected from the group consisting of Sb, In, Al, Mg and Cd, the balance of the alloy consisting essentially of Cu,

said alloy bonded to a backing metal and having on its side opposite to the backing metal a roughened surface of approximately 0.5 to approximately 10 μm of roughness (R_z); and

said alloy having ~~defined~~ a first layer parallel to and adjacent to said backing metal, and a ~~sublayer~~ second layer that is not directly adjacent to said backing metal;

wherein said roughened surface is coated with a coating layer comprising at least one thermosetting resin, which is selected from the group consisting of polyimide resin, polyamide-imide resin,

epoxy resin and phenol resin, and which contains from 55 to 95% by weight of MoS₂, and wherein said roughened surface is formed of grooves extending in the sliding direction;

wherein said Ag and Sn and said at least one additive element are solid-dissolved in the Cu matrix of the copper alloy in at least the ~~vicinity of~~ area adjacent said roughened surface, where essentially no secondary phase of Ag or Sn or said additive element, or a secondary phase of any combination of these, is formed;

and

wherein ~~at least a portion of said sublayer~~ second layer contains a component consisting of:

solid-dissolved Ag and Sn and said additive element,

a hexagonal compound of solid-dissolved Ag and Sn and said additive element,

a hexagonal compound of solid-dissolved Cu and Ag and Sn and said additive element,

a eutectic of solid-dissolved Ag and Sn and said additive element, or

a eutectic of Cu and solid-dissolved Ag and Sn and said additive element;

in higher total atomic concentration of Ag and Sn and said additive element than that of said first layer ~~nearest said backing metal~~.

4. (Three times Amended) A sliding bearing according to claim 1, wherein said roughened surface is ~~formed~~ further roughened by shot-blasting, etching, flame-spraying or chemical treatment.

9. (Two times amended) A sliding bearing according to claim 2, wherein said roughened surface is ~~formed~~ further roughened by shot-blasting, etching, flame-spraying or chemical treatment.

11. (Amended) A sliding bearing according to claim 1, wherein the ~~total atomic~~ concentration of Ag and Sn in said ~~sublayer~~ second layer of said ~~solid-dissolved Ag and Sn, said hexagonal compound, or said eutectic~~ second-layer component is at least 1.3 times higher than that of said first layer nearest said backing metal.

12. (Amended) A sliding bearing according to claim 2, wherein the ~~total atomic~~ concentration of Ag and Sn in said ~~sublayer~~ second layer of ~~solid-dissolved Ag and Sn and said additive element, said hexagonal compound, or said eutectic~~ said second-layer component is at least 1.3 times higher than that of said first layer nearest said backing metal.